Operation and achievements of the DBCP

(November 2003)

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1. Operation of the DBCP

1.1. A forum of people:

The DBCP is a forum of people interested in the data buoy technology. The DBCP meets yearly, normally in October, switching between Northern Hemisphere and Southern Hemisphere venues. A technical and scientific workshop is held in conjunction with each Panel session. This is an excellent opportunity to discuss technical issues related to data buoys in the light of applications of buoy data. Participants in the meeting and/or workshop include representatives of meteorological agencies, oceanographic institutes, scientists, data telecommunication providers, and manufacturers. Contacts, exchange of information, assistance is facilitated during the intersessional period because people know each other and because the DBCP is served by a Technical Coordinator.

DBCP Chair and vice-Chairs have regional responsibilities, i.e. Europe, Asia, Southern Hemisphere, and North America. In 2003, the following individuals were elected and appointed by the Panel:

Elected:

- Chairman (and European region): David Meldrum, SAMS, UK
- Vice-chair, Asia: K. Premkumar, NIOT, India
- Vice-chair, North America: Elizabeth Horton, Navoceano, USA
- Vice-Chair, Southern Hemisphere: Louis Vermaak, SAWS, South Africa

Appointed:

- Technical Coordinator: Etienne Charpentier, France

1.2. Information Exchange

Information exchange is realised primarily through the DBCP session and workshop but also through the following media:

- **DBCP web site** (http://www.dbcp.noaa.gov/dbcp)

- **DBCP Internet forum** (http://forum.jcommops.org/)

- **Mailing lists**:

  - dbcp@jcommops.org : General mailing list for DBCP members (general information).
  - buoys@jcommops.org : Mailing list for buoy operators (technical issues).
  - dbcpeval@jcommops.org : Mailing list for the DBCP evaluation group.
  - buoy-qc@vedur.is : Mailing list dedicated to reporting of buoy data systematic errors.

- **DBCP Publication series**: Series now includes 23 publications dealing with subjects such as Argos system, GTS sub-system, buoy technology and applications, SVPB evaluation, SVPB construction manual, DBCP annual reports.

- **Technical Coordinator** who acts as a focal point between buoy operators, meteorological or oceanographic centres, Service Argos, etc... For example he can provide users with information on buoy technology, and data telecommunication systems that he can easily obtain from relevant experts.

- **Brochure**: general information regarding the DBCP and its activities is given in a recently published brochure.

1.3. Strong body for negotiating with telecommunication providers and buoy manufacturers:

The DBCP is a strong body for negotiating with satellite data telecommunication providers (e.g. Argos) and buoy manufacturers. For example, the DBCP collects requirements from all buoy operators and negotiates with Service Argos inclusion of those into the Argos development programme. A flexible and efficient Argos GTS sub-system was developed by Service Argos according to technical specifications written by the DBCP. This could not have been requested by a national agency alone. This also facilitates standardisation (see paragraph 2.5).

1.4. Technical expertise

The DBCP comprises experts, or can rely upon expertise, in fields such as:

- Buoy and sensor technology, including deployment (e.g. by air)
- Data telecommunication and location (e.g. DBCP is presently evaluating various systems)
- Data processing and data management
- Data quality control
- Data assimilation and Numerical Weather Prediction (NCEP, ECMWF..)
- Oceanographic research (e.g. GDP)

…

1.5. Coordination

The DBCP employs a full-time Technical Coordinator using funds provided voluntarily by panel Member countries. The first Technical Coordinator, Mr. David Meldrum, was hired in June 1987 and was based at CLS, Service Argos in Toulouse. The second Technical Coordinator, Mr. Etienne Charpentier, was hired in June 1989 and was based in Service Argos, Inc. in Largo, USA until June 1993, when the position was moved to Toulouse.

The DBCP Technical Coordinator:

- **Acts as a focal point**. The Technical Coordinator knows with whom the expertise lies, and can be contacted to identify experts in the field of data buoys and their applications.

- **Identifies new partners and convinces them to share data**. The TC has access to Argos files and can identify new buoy operators. Buoy operators which do not participate in the DBCP may be interested to join in or can be convinced to share their data in real-time through GTS distribution.

- **Makes proposals and recommendations**. Since the TC is constantly in contact with key players in the buoy community, e.g. buoy operators, buoy data users, Service Argos, he is in a good position to make proposals and recommendations regarding Quality Control of buoy data, data processing, GTS issues (e.g. code forms, GTS bulletin headers), potential cooperation between buoy operators.

- **Helps to fix technical problems**. Since the TC uses office spaces at Service Argos part of the time, it is easier to fix technical problems related to the system or to GTS distribution of the data. On other technical issues, since he is aware of the most common problems that occur, he can suggest usual solutions and call for expertise within the DBCP community.

- **Acts as a catalyst** among different players to speed up certain processes (e.g. cooperation between meteorologists and oceanographers regarding evaluation and deployment of SVPB drifters).

- **Informs the buoy community of the status of buoy programmes.** This is now done primarily through the DBCP web server and through reporting mechanisms to DBCP Action Groups and by the Technical Coordinator to the DBCP itself.

1.6. Regional Action Groups

Action Groups focus deployment of buoys in a particular ocean area (e.g. International South Atlantic Buoy Programme) or for a particular application (e.g. Global Drifter Programme). This permits to satisfy national interests but also to integrate buoy programmes in a regional and then global perspective. Deployment opportunities are more easily managed at the regional level and coordination is made easier.

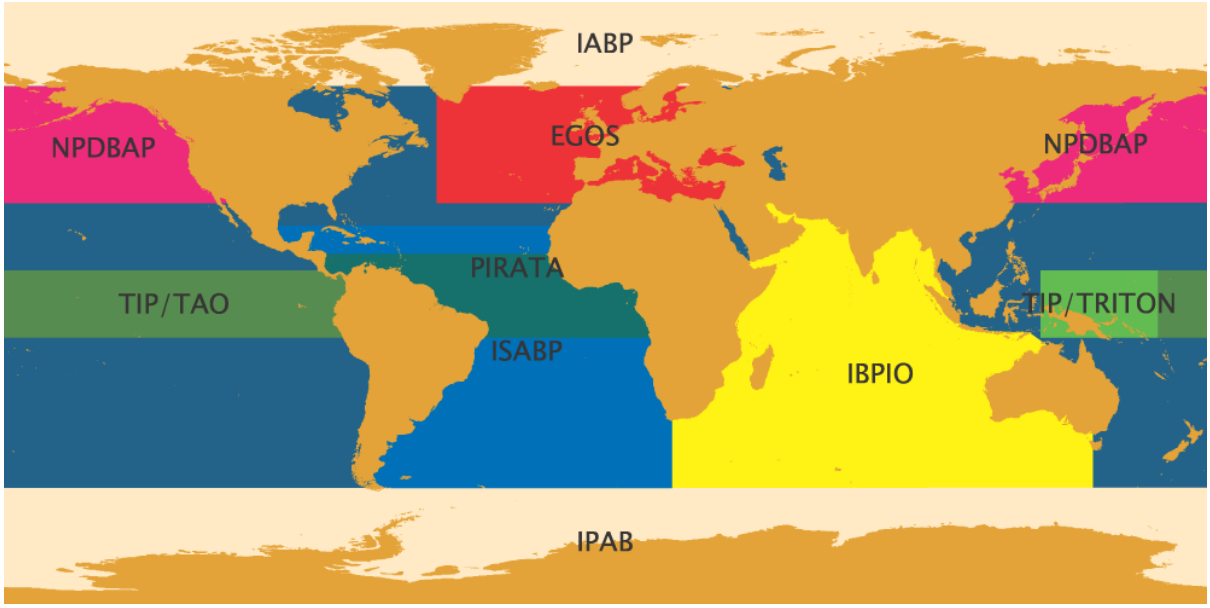
Regional (or global) Action Groups are independent self-funded bodies that maintain an observational buoy programme in support of the WWW, WCRP, GCOS and GOOS. They agree to exchange good quality basic meteorological and/or oceanographic data in real time over the GTS. They also agree on exchange of information on data buoy activities and development and transfer of appropriate technology. They submit annual reports to the DBCP. Regional Action Groups usually engage their own coordinators, who work closely with the Technical Coordinator of the DBCP.

They receive support from the DBCP through DBCP officers, DBCP TC, WMO and IOC secretariats. DBCP is normally represented at the AG meetings, and AG are represented at DBCP meetings.

Present DBCP Action Groups are:

- EGOS: European Group on Ocean Stations (focus on the North Atlantic, http://www.shom.fr/meteo/egos/)
- IABP: International Arctic Buoy Programme (http://iabp.apl.washington.edu/)
- WCRP IPAB: WCRP International Programme for Antarctic Buoys (http://www.antcrc.utas.edu.au/antcrc/buoys/buoys.html)
- ISABP: International South Atlantic Buoy Programme (http://www.dbcp.noaa.gov/dbcp/isabp/)
- IBPIO: International Buoy Programme for the Indian Ocean (http://www.meteo.shom.fr/ibpio/)
- NPDBAP: DBCP-PICES North Pacific Data Buoy Advisory Panel (http://npdbap.noaa.gov/).
- GDP: Global Drifter Programme (http://www.aoml.noaa.gov/phod/dac/gdp.html, was SVP, Surface Velocity Programme)
- TIP: Tropical moored buoy Implementation Panel (TAO: http://www.pmel.noaa.gov/tao/, TRITON: http://www.jamstec.go.jp/jamstec/TRITON/, PIRATA: http://www.pmel.noaa.gov/pirata/)

For deployments of buoys in the Southern Ocean, the DBCP integrated a Southern Ocean Buoy Programme (SOBP) in its implementation strategy tentatively maintaining an array of some 80 drifting buoys south of 50S. There was no need to establish a SOBP Action Group because most of the deployments in the region are made through other DBCP Action Groups (e.g. ISABP, IBPIO, IPAB, GDP). SOBP implementation issues are therefore discussed at DBCP sessions.



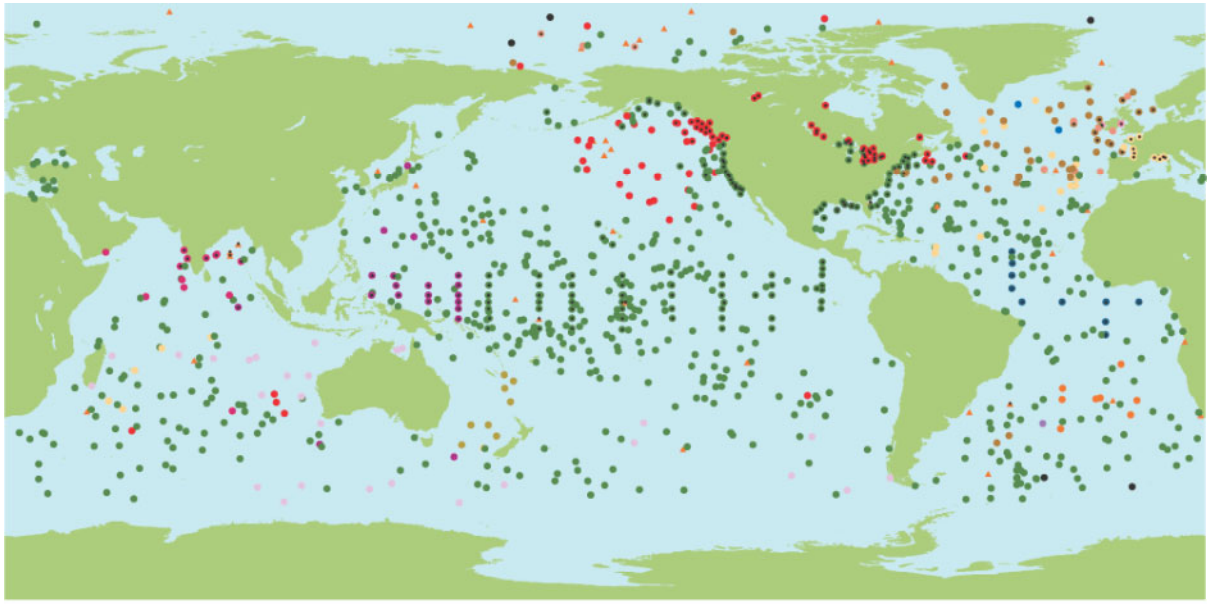
2. Achievements

2.1. More buoys deployed

Since establishment of the DBCP, numbers of buoys deployed have increased and particularly those reporting on the GTS.

Year	Buoys	Buoys on GTS	Reports/day	air pressure obs/day
1991	720	350 (48%)	1300	650 (50%)
1995	1400	600 (43%)	3000	2000 (66%)
2000	1313	768 (59%)	8500	4650 (55%)
2003	1409	759 (53%)	14500	7800 (54%)

Substantial increase in the number of reports per day between 2002 and 2003 is due to DBCP recommendation at its 18th session, October 2002, to distribute as many hourly data as possible. Previously, such data were filtered out but as recent impact studies showed, hourly surface pressure data have positive impact upon the quality of NWP models.



2.2. Quality of buoy data is recognised as good

Thanks to improvements in data assimilation as well as improvements in the numerical weather prediction models themselves, and to a lesser extent to the DBCP quality control guidelines, observed buoy data now agree very well with the models. Buoy technology has not changed dramatically in the last 10 years. In fact, when the SVPB was designed and before it was tested at sea, concerns were expressed regarding expected quality of pressure data from those buoys (e.g. buoy submerged, new cheaper barometer used). Facts showed that both standard FGGE type buoys as well as new SVPBs produced reliable pressure observations. What

the buoy community knew, however, was a difficult message to pass through the NWP community. Improvement of NWP techniques permitted to demonstrate that the buoy data quality was indeed very good.

For example, standard deviation of observed pressure data from buoys minus first guess pressure field of ECMWF model was in the order of 2.5 hPa in 1990. In 2000, it dropped to about 1.2 hPa, and 1 hPa in 2003. As a result, modellers are now confident in the quality of buoy data, including air pressure (1 hPa SD), wind speed (2.3 m/s SD), wind direction, and SST (0.7C SD).

2.3. Argos GTS sub-system

Before 1993, when a buoy operator wanted his buoy data to be distributed on the GTS, he had to follow very strict standards as far as Argos message format was concerned. Sensors has to be placed in a certain order, the set of available types of calibration curves was limited, it was not possible to distribute the back-hour data on the GTS, and only very limited quality control checks were done. Besides, if a buoy reported on the GTS, the buoy operator could not recover the raw data since the GTS required to process the data in geophysical units and the standard Argos data processing system was used for that purpose.

There were in fact a number of buoy operators who agreed to distribute their buoy data on the GTS, but for whom this was not possible for technical reasons.

The DBCP therefore decided to ask Service Argos to develop a separate flexible system dedicated to GTS distribution of Argos platforms. The Technical Coordinator wrote the specifications, development work was evaluated and sub-contracted. DBCP agreed to pay for a part of the development costs ($90K). The rest was included within the Argos development programme and reimbursed through the Argos Joint Tariff Agreement. The project was developed in 2 phases. Phase 1 started in July 1991, and was implemented in February 1993. Phase 2 started in October 1992, and was implemented in September 1993.

The GTS sub-system has been closely monitored by the Technical Coordinator and improvements proposed over the years. Specifications of the present system include among other things:

- No interference with Argos users' needs (e.g. he can get the raw data)
- Recognising almost any kind of Argos message formats
- Wide range of calibration curves (tables, polynoms, formulae, specific algorithms)
- Processing timers and time of observation
- Automatic quality control checks (gross errors, dedicated sensor limits, sensor blockage, checksum)
- Geo-magnetic variation model (for wind direction sensors)
- Reduction of pressure to sea level (for remote stations in altitude)
- Data encoded according to WMO regulations (BUOY, SYNOP, SHIP, BATHY, TESAC, and BUFR)
- Processing GPS data and interpolation between locations
- Compression for identical Argos messages and identical sensor observations
- Automatic remote technical file access (via email)
- Processing of profile data (e.g. XBTs, Argo profiling floats)
- Delayed mode distribution (i.e. waiting to collect all necessary information during a given period before actually distributing a report on GTS; this is particularly useful for sub-surface profiling floats which may transmit the data of one single profile through many satellite passes)

BUFR table driven code was implemented in early July 2003. It is more flexible, and permits GTS distribution of variables that cannot be distributed in BUOY format (BUOY is now frozen), e.g.

a. Data collection and/or location system
b. Platform transmitter ID
c. Platform battery voltage (used to be coded as housekeeping parameter)
d. Transmitter battery voltage
e. Receiver battery voltage
f. Submergence (used to be coded as housekeeping parameter)
g. Drogue status (now drogue depth independent from drogue status)
h. Ice thickness (for ice-buoys)
i. Temperature of barometer

j. Height of instrument (pressure, temp., humidity, wind, precip.)
k. Wind gust
l. Precipitations
m. Global radiation

Argo automatic real-time quality control tests were implemented in October 2003

2.4. Quality Control guidelines

In 1992, the DBCP established so called "Quality Control Guidelines" as a way to rationalise and speed up the buoy status change process for those buoys reporting on the GTS (e.g. remove a buoy from GTS, recalibrate a sensor). There was also a recognition that the Meteorological and Oceanographic centres, and especially those running global models were in the best position to undertake deferred-time quality control procedures and comment upon the quality of buoy data. The scheme was later formally included by CBS as part of the World Weather Watch.

The scheme is based on an Internet mailing list (buoy-qc@vedur.is) which is used by all actors involved in the process. The mailing list is operated by the Icelandic Meteorological Office. Particularly, when felt necessary, and according to quality control procedures they undertake on their own, Principal Meteorological or Oceanographic Centres (PMOC) responsible for buoy data Quality Control can make status change proposals by means of the mailing list. The subject line of status change proposals is standardised in order to facilitate automatic data processing of the messages.

For each buoy programme, only one person is responsible for asking Service Argos or Local User Terminals (LUT) to effectively implement status changes. This person is designated by the programme Principal Investigator or operator and is called Principal GTS Coordinator (PGC).

The Technical Coordinator of the DBCP, acting as a focal point between these centres and the owners of the buoys, forwards the proposals to them. Some of the proposals are automatically forwarded to the PGC in case the latter has an email address.

In addition, monthly buoy monitoring statistics produced by PMOCs are available on the mailing list.

In 2003, a dedicated web page (http://w3.jcommops.org/cgi-bin/WebObjects/QCRelay) was implemented to allow PMOCs to directly report on systematic errors via the web. The web page remains complementary to the mailing list.

2.5. Standardization

Instrumentation: Standardization of instrumentation has always been an important issue within the DBCP. As a result, strong cooperation was put in place between meteorologists and oceanographers deploying drifting buoys and common designs are now being used (SVP, SVPB, SVPBW). See paragraph 2.12 for details.

Data telecommunication formats: The DBCP defined sets of recommended data telecommunication formats for the transmission of the raw data through the Argos system (http://www.dbcp.noaa.gov/dbcp/1ramf.html). This facilitates implementation of technical files at Service Argos upon deployment of buoys. It also permits new partners in the programme to quickly set up buoy programmes.

Quality Control and information: Simple automatic quality control checks had been implemented within the Argos GTS sub-system (see DBCP publication No. 2 which references are given in paragraph 2.15 for details). Deferred-time Quality Control is the responsibility of data users and NWP centres. However, a standardized quality information feed-back mechanism was put in place by the DBCP (see 2.4) and permits relay of quality information from data users back to buoy operators.

2.6. Collection of metadata

A synthesis of DBCP members' comments regarding the metadata issue was submitted to the JCOMM Sub-group on Marine Climatology in January 2000 (see http://dbcp.nos.noaa.gov/dbcp/metadata.html). The sub-group met in early 2000 and took the DBCP recommendations into account. At its first session in Akureyri, Iceland, 19-29 June 2001, JCOMM recommended that the format agreed upon by its sub-group on Marine Climatology be used as the global format for the assembly, exchange and archival of metadata from all types of ODAS, including, in particular, drifting and moored buoys and fixed platforms.

To assist in preparing the compilation of the final catalogue, DBCP members and the Action Groups had to compile their own metadata catalogues, with a view to submitting them when required in a format as close as possible to the one that proposed by JCOMM. On the other hand, for drifting buoys, the panel, at its 16th session in Victoria, October 2000, noted that a good way to collect most of the metadata was to ask buoy manufacturers to fill out a standardized sheet each time a new drifting buoy was being delivered. Calibration procedures for buoys should be adequately documented and archived. Panel members are urged to provide the JCOMM Sub-group on Marine Climatology with related calibration information as well.

In 2002 and 2003, a metadata relational model was defined by EGOS in cooperation with the DBCP. Specifications were written for a web based global buoy deployment notification scheme to facilitate collection of metadata. Notification is planned in two steps, i.e. (i) by buoy manufacturers upon buoy purchase, and (ii) by buoy operators upon buoy deployment. Buoy manufacturers are indeed in the best position to provide the metadata so most of the metadata will be collected through step 1.

Regarding inclusion of metadata in GTS reports, the CBS and its Implementation Coordination Team on Data Representation and Codes accepted as ultimate modification of the BUOY code inclusion of certain metadata (e.g. anemometer height, buoy type, drogue type) in the BUOY code. This was implemented on 8 November 2001. As of July 2003, GTS distribution of buoy data in BUFR format also permits more metadata to be included in the real-time data-flow (e.g. name of data collection system, platform transmitter ID, drogue status, height of other instruments than anemometer such as barometer, thermometer).

2.7. DBCP Implementation strategy

The DBCP was established in 1985, jointly by the WMO and IOC, as a means of enhancing cooperation, coordination and information exchange among the operators and users of drifting buoys, meteorological and oceanographic, research and operational, with a view to improving both the quantity and quality of buoy data available on the Global Telecommunications System of WMO in support of major programme requirements of the two Organisations. In 1992 its terms of reference were widened and its name changed from Drifting Buoy Co-operation Panel to Data Buoy Co-operation Panel, to reflect its work in coordinating all forms of ocean buoy deployments.

During the 15 years of its existence, the panel has had great success in achieving its initial objectives. At the same time, this period has also seen advances in both buoy and communications technology, as well as greatly enhanced and expanded requirements for buoy data, in particular in support of global climate studies. Major global experiments such as TOGA and WOCE have clearly demonstrated the value of buoy data for this purpose, and at the same time established and refined the buoy networks needed to fulfill the scientific requirements. One of the major challenges now facing the panel and buoy operators is to convert the buoy networks established for these experiments into long-term operational programmes.

In recognition of these new developments and expanded requirements, and in the context also of the implementation plans and requirements of the Global Ocean Observing System (GOOS) and the Global Climate Observing System (GCOS), the panel agreed in 1997 on the need for a DBCP Implementation Strategy, which would provide an overall framework for the panel's work, and at the same time enable it and its members to react appropriately to future developments. A draft strategy document was prepared for the panel by Mr David Meldrum, reviewed and revised at the panel session in 1998, and has been published in the DBCP Technical Document series (No. 15). The strategy document is also available through the DBCP web server (http://www.dbcp.noaa.gov/dbcp/dbcp15.html).

2.8. Vandalism.

DBCP is cooperating with relevant international organizations such as IHO to address the vandalism issue.

For example, IHO agreed to promulgate navigational warning messages on the presence of data buoys in the seas and the necessity of their safety for assistance to mariners, in particular during bad weather times. Such messages are based upon information provided by the DBCP (see documents on the DBCP web site which are available for DBCP members to use as needed at http://www.dbcp.noaa.gov/dbcp/vandalism.html and http://www.dbcp.noaa.gov/dbcp/vandalism.pdf).

The issue was also discussed at the first meeting of JCOMM, Akureyri, Iceland, 19-29 June 2001. JCOMM recommended Member States (i) to contact their respective Hydrographic Services to reinforce the message in the "Hydrogram" and to ensure that it is reissued as often as possible; (ii) to develop, if possible, tamper proof designs for buoy systems; (iii) to design a warning system in the event any data buoys were intentionally damaged; and (iv) to take legal steps nationally to limit acts of vandalism within their territorial seas and Exclusive Economic Zones.

2.9. Safety.

Following explosion in august 2001 of a moored data buoy during maintenance onboard a ship in the Bay of Bengal which resulted in the death of a crew member, the Indian National Institute for Ocean Technology (NIOT) who operated the buoy constituted an expert committee to examine the incident. The committee included distinguished scientists in mechanical and electrical engineering, battery development and manufacture, forensic science and pressure vessels. This committee had concluded that the explosion was due to the emission of hydrogen and oxygen from overcharged batteries, ignited by an electrical spark. The recommendations of the expert committee were then placed before the Data Buoy Cooperation Panel and the issue was discussed further with the buoy operator represented by Dr. K. Premkumar, Panel Members, and manufacturers at its 17th session in Perth, 22-26 October 2001. Finally, the DBCP made specific recommendations which can be found at http://www.dbcp.noaa.gov/dbcp/safety.html.

2.10. Buoy Evaluation.

Before 1992, oceanographers only deployed so called standard SVP Lagrangian drifters in order to measure primarily sea surface currents. The only geophysical sensor installed on the drifters was for Sea Surface Temperature. At the same time, they encouraged meteorologists to install large drogues on their FGGE type buoys in order to increase their drag area ratio and therefore increase their water following characteristics (reduce slip due to wind stress, vertical current shear, surface gravity wave effect). However, installing a drogue on a FGGE type meteorological buoy does not transform it into a real Lagrangian drifter. Only small spherical hulls with large drogue attached and drag area ratio > 40 are considered as Lagrangian. In practice, only a very small number of drogues had been attached to meteorological buoys, and only to slow them down and keep them longer in a given ocean area rather than to increase their water following characteristics. Cooperation between the two communities in the buoy business was in fact very small.

WOCE funded the development of a Lagrangian drifter equipped with a barometer. Because of the drogue and designed buoyancy, a Lagrangian drifter is regularly submerged by the waves. Measuring atmospheric pressure in those conditions was therefore a challenge. Developments were conducted at Scripps Institution of Oceanography by Peter Niiler and Andy Sybrandy. The DBCP felt that this was a good opportunity to make the two buoy communities (on the meteorological and on the oceanographic side) cooperate to a larger extent and pushed its members to purchase prototypes and test them. This was a success, agencies from five countries accepted to buy and test the drifter. 25 prototypes were initially deployed and evaluation was done in cooperation between the two communities. Two evaluation workshops were organised, in May 1993 and May 1995, respectively in La Jolla at SIO, and New Orleans. Design modifications were proposed. This was the real start of an excellent cooperation between oceanographers and meteorologists within the DBCP.

In May 1999, the Panel established a DBCP sub-group on SVPB/Minimet evaluation to evaluate the so called SVPBW or Minimet, a new technology to measure wind speed using WOTAN (wind observation through ambient noise).

At its 17th session in Perth, October 2001, the panel agreed that the sub-group had proved successful and had led to significant improvements in the quality of the data produced by these instruments. At the same time, the panel agreed that there was a need (i) to evaluate other types of buoys or instruments (e.g. moorings, thermistor strings) but also (ii) to routinely discuss other technical issues such as DBCP recommended Argos

message formats, or to define specific DBCP criteria regarding life-times, early failures, ocean areas, etc. The Panel therefore decided to extend the terms of references of the group to become a more general DBCP evaluation group. The subgroup is chaired by Elizabeth Horton, primarily works via email (dbcpeval@jcommops.org mailing list), meets annually in conjunction with DBCP workshops, and reports to the DBCP at panel sessions.

The Terms Of References of the DBCP Evaluation Group are:

(1) When required by the DBCP, evaluate quality of buoy data produced by specific types of buoys, as well as functioning, efficiency, and possibly suggest design changes for improvement (sensors, hardware, software, data formats).
(2) Suggest specific tests and/or evaluation deployments in different sea conditions to DBCP members in order to evaluate buoy quality as described in (1) above.
(3) Share experience and results of evaluation with the DBCP and other interested parties.
(4) Work on specific technical issues in order to facilitate standardization (e.g. DBCP recommended Argos message formats).
(5) Define specific criteria for evaluation purposes (e.g. ocean areas, definition of acceptable quality data, e.g. early failures, life-times, delays, accuracies, resolutions, etc.)
(6) Meet annually in conjunction with the DBCP Technical Workshop.
(7) Report on its activities and results at DBCP sessions.

The following people were part of the evaluation Group in 2003 (alphabetic order):

- Pierre Blouch, Météo France
- Etienne Charpentier, DBCP
- Tony Chedrawy, Metocean
- Julie Fletcher, MSNZ
- Elizabeth Horton, Navoceano (Chairperson)
- Ken Jarrott, BOM
- Ron McLaren, MSC
- Eric Meindl, NOAA/NDBC
- David Meldrum, SAMS
- Sergey Mothyzev, MHI/Marlin-Yug
- Peter Niiler, SIO
- Sarah North, UKMO
- Mayra Pazos, NOAA/AOML
- Satheesh Chandra Shenoi, NIO
- Andy Sybrandy, Pacific Gyre
- Louis Vermaak, SAWB
- Paul Whiteley, UK MetOffice
- Gary Williams, Clearwater Instrumentation
- Jeff Wingenroth, Technocean

2.11. Impact studies.

DBCP is maintaining information regarding impact of buoy data upon Numerical Weather Prediction. Details can be found at: http://www.dbcp.noaa.gov/dbcp/impact.html

2.12. Actual cooperation between meteorologists and oceanographers

After the first SVPB evaluation phase (evaluation is considered as an ongoing process), meteorologists began to purchase SVPBs for their own purposes to replace the FGGE type buoys. This is the case for example for the South African Weather Bureau, Météo France, the Australian Bureau of Meteorology, and the United Kingdom Meteorological Office.

SVPB meets both communities needs:

For meteorologists, it is equipped with a barometer and a SST sensor and reports onto the GTS. It is drogued and therefore stays longer in a given area. It is cheaper than regular FGGE type buoys measuring the same variables.

For oceanographers, it is an excellent Lagrangian drifter which has been calibrated for that purpose. Surface velocity correction due to wind stress can even be applied thanks to a formula. Because the drifter is equipped with a barometer, and reporting on GTS, one can expect to obtain better wind fields from the meteorological agencies for making this correction.

Since standard SVP drifters continue to be deployed by oceanographers, meteorological agencies can use this potential and pay to upgrade SVPs to SVPBs for only the cost of a barometer. Météo France is presently upgrading 10 drifters a year for deployments in the Indian Ocean. This is an excellent example where resources are shared.

2.13. Action groups established through Panel support and/or action:

The Panel took steps to support, initiate and create the following Action Groups:

- IABP: International Arctic Buoy Programme (1991)
- ISABP: International South Atlantic Buoy Programme (1994)
- IBPIO: International Buoy Programme for the Indian Ocean (1996)
- NPDBAP: DBCP-PICES North Pacific Data Buoy Advisory Panel (2002)

Within DBCP implementation strategy:

- SOBP: The Southern Ocean Buoy Programme is not a DBCP Action Group as it involves work from many of the other Action Groups. It is directly included as part of the DBCP implementation strategy and coordinated at the DBCP level (e.g. at Panel sessions).

2.14. Existing programs who joined as DBCP action groups:

The following Action Groups decided to join the DBCP after they had been created:

- EGOS: European Group on Ocean Stations (joined in 1987)
- IPAB: International Programme for Antarctic Buoys (joined in 1994)
- GDP: Global Drifter Program (joined in 1996)
- TIP: Tropical moored buoy Implementation Panel (joined in 1998)

2.15. Technical document series initiated

The DBCP document series, which was initiated in 1995, contains the following publications:

- No. 1: DBCP Annual Report for 1994
- No. 2: Reference Guide to the GTS Sub-system of the Argos Processing System (available on-line at http://www.dbcp.noaa.gov/dbcp/Argos-GTS-sub-system-ref-guide-rev-1-3.pdf)
- No. 3: Guide to Data collection and Location Services Using Service Argos (available on-line at http://www.dbcp.noaa.gov/dbcp/Argos-guide.pdf)
- No. 4: WOCE Surface Velocity Programme Barometer Drifter Design Reference (available on-line at: http://www.dbcp.noaa.gov/dbcp/SVPB-design-manual.pdf)
- No. 5: Surface Velocity Programme Joint Workshop on SVPB drifter evaluation
- No. 6: DBCP Annual Report for 1995
- No. 7: Developments in buoy technology and enabling methods (DBCP workshop, Pretoria, Oct. 1995)
- No. 8: Guide to moored buoys and other ocean data acquisition systems
- No. 9: DBCP Annual report for 1996
- No. 10: Development in buoy and communications technologies (DBCP workshop, Henley on Thames, Oct. 1996)
- No. 11:DBCP Annual report for 1997
- No. 12: Developments in buoy technology and data applications (DBCP workshop, La Réunion, Oct. 1997)
- No. 13: DBCP Annual report for 1998
- No. 14: Variety in buoy technology and data applications (DBCP workshop, Marathon, Florida, Oct. 1998)
- No. 15: Global drifting buoy observations, A DBCP Implementation Strategy
- No. 16: Annual report for 1999
- No. 17: Developments in moored and drifting buoy design, programmes, sensors, and communications (DBCP workshop, Wellington, New Zealand, Oct. 1999)
- No. 18: DBCP annual report for 2000.

- No. 19: Developments in buoy technology, communications, and data applications (DBCP Workshop, Victoria, Oct. 2000).
- No. 20: DBCP annual report for 2001 (available on-line at http://www.dbcp.noaa.gov/dbcp/doc/dbcp20-annual-report-2001.zip)
- No. 21: Dev. in buoy technology, communications, science and data applications (DBCP Workshop, Perth, Oct. 2001) (available on-line at http://www.dbcp.noaa.gov/dbcp/doc/DBCP-21/TOC.doc)
- No. 22: Research, applications and developments involving data buoys (DBCP Workshop, Martinique, Oct. 2002) (available on-line at http://www.dbcp.noaa.gov/dbcp/doc/DBCP-22/start.doc)
- No. 23: DBCP Annual report for 2002 (available on-line at http://www.dbcp.noaa.gov/dbcp/doc/dbcp-23/DBCP23.pdf)

2.16. Web site

A web site was established at NOAA/NOS in February 1995. Since then it has regularly evolved and now contains a substantial amount of information:

- General information on the DBCP
- Global Implementation
  - Implementation strategy
  - Action Groups and link to AG web sites
  - National reports
  - Buoy deployment methods
  - Buoy recovery
  - Buoy deployment opportunities and contact points
  - National focal points for logistic support
- Quality Control
  - Description of QC guidelines
  - Archived QC messages
  - Monthly buoy monitoring statistics
- Technical developments (e.g. SVPB)
- Data collection and location
  - Argos system
  - Recommended Argos message formats
  - Data telecommunications systems
- Buoys (includes list of buoy manufacturers)
- Application of buoy data
- GTS
  - What is the GTS?
  - Benefits to you of sending your buoy data onto the GTS
  - Inserting buoy data on GTS: how and why?
  - Data flow monitoring tools (are my data actually being distributed on GTS?)
  - The Argos GTS Sub-System
  - WMO Numbers (How to obtain WMO numbers?, WMO/Argos cross ref. list)
  - GTS Bulletin Headers
- Status information, graphics, maps
- Contacts (DBCP officers, National Focal Points, NFP for logistic support, PGCs, WMO, IOC)
- Documentation (list of DBCP publications, some available in electronic format)
- List of meetings of interest for the buoy community
- Related web-sites

2.17. Internet Forum

In May 1999, the DBCP opened an Internet technical forum (now renamed to http://forum.jcommops.org/ to include SOOP and Argo forums as well) as a means of debating on technical issues, answering technical questions, and exchanging information among buoy operators or actors. The forum is a good complement to

the DBCP web site and is directly linked to it. Documents, questions and answers can be exchanged over the forum while being accessible to anybody in the buoy community.

The forum presently includes the following themes:

- Argos (open to everyone)
- DBCP (open to everyone)
- GTS (open to everyone)
- SVPBW evaluation (reserved for DBCP evaluation group)

And "Teams":

- DBCP team (reserved to DBCP members, including Action Groups).
- EGOS team (reserved to EGOS members).

If desired, new teams dedicated to DBCP Action Groups could be created on the forum with privileged access for AG Participants and administration privileges for the AG Coordinator.

2.18. Integration

The DBCP now reports to the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). It is following requirements expressed by the WWW, GOOS, and GCOS and is working in an integrated way in the context of the JCOMM Observations Programme Area (OPA). In that regard, the DBCP is cooperating with other Panels dealing with other types of *in situ* observing systems such as the Ship Of Opportunity Programme Implementation Panel (SOOPIP), the Argo sub-surface profiling float programme, the Voluntary Observing Ships Programme (VOS), and the Automated Shipboard Aerological Programme Implementation Panel (ASAPP).

The DBCP is particularly supporting financially (jointly with SOOP and Argo) the operations of the JCOMM *in situ* Observing Platform Support Centre (JCOMMOPS, http://www.jcommops.org/) in Toulouse. JCOMMOPS includes the DBCP, SOOP, and Argo International Coordination Facilities. JCOMMOPS particularly provides information on deployment opportunities for drifting buoys and floats, as well as status information regarding drifting and moored buoy programmes, XBT programmes (SOOP), and sub-surface profiling float programmes (Argo)